Bulletin 596

TERRARIUMS

Cooperative Extension Service ○ The Ohio State University

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To simplify information, trade names of products have been used. No endorsement is intended, nor is criticism implied of similar products not named.

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TERRARIUMS

Increased interest in terrariums, evidenced in recent years, might lead one to believe they are a modern phenomenon, but this is not the case. It is believed that terrarium culture was practiced as early as 500 B.C. by the ancient Greeks to prepare plants for ceremonial occasions. In modern times, the idea of placing plants in an enclosed container with the subsequent creation of a microclimate conducive to good growth was discovered accidentally by Dr. Nathaniel Ward in 1829. While conducting other experiments, Dr. Ward found that seeds and spores germinated in an enclosed container, and that plants not only survived in this "airless" situation but grew more vigorously than he had ever before witnessed. His findings put to rest the then prevalent notion that plants must have ventilitation in order to survive.

The Wardian case of the 19th century was of great interest to the indoor plant enthusiast because it offered protection against the severe temperature fluctuations unavoidable in homes of that time. In addition, tender plants could now be shipped long distances with good success, and new and unusual varieties of plants were introduced around the world. The Wardian case proved to have profound economic effects on world trade. England was now able to start producing tea and rubber by shipping tea plants from China to India and rubber plants from Brazil to Ceylon, thus lessening her economic dependence on other countries.

Today, terrariums no longer play this type of economic role. In addition, the advent of thermostatically-controlled central heating and cooling has improved the adverse conditions for plant growth found in the average home. The value of the terrarium in the 20th century is a functional and ornamental unit in which plants can thrive with very little attention.

Why are so many people making and buying terrariums? Why do plants grow well inside an enclosed container?

Questions such as these have probably come to mind over the past few years, during which time trerarium culture has gained prominence among garden center operators, florists, and other growers of indoor plants.

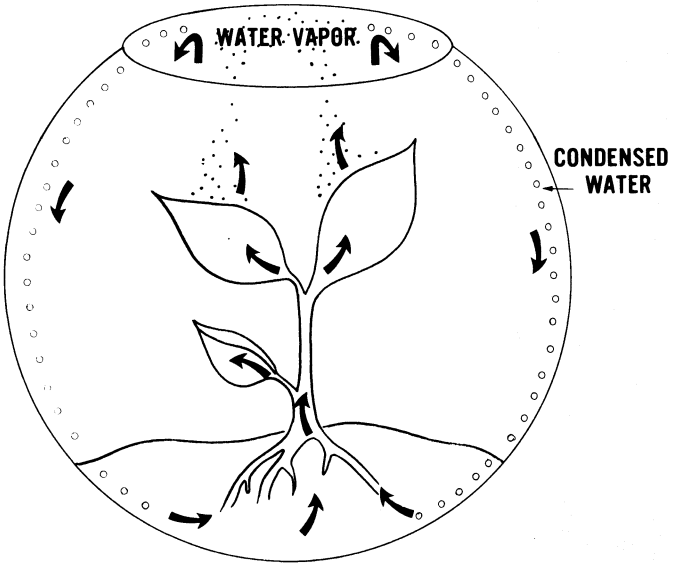
The average consumer today expects the ready availability of terrarium containers, construction supplies, and plants in garden centers. Florists now offer terrariums as an alternative to cut flower arrangements and conventional planters. Terrariums are often seen for sale in department stores and specialty shops.

Why are so many people making and buying terrariums? A partial explanation lies in the fact that terrariums not only are strikingly attractive and an asset to any decor but also require a minimum of attention and will prosper for the most amateur plant enthusiasts, regardless of how inexperienced they may be. Perhaps most important of all, a terrarium can be a creative outlet and a source of great personal satisfaction as well as a beautiful addition to any home.

Why do plants grow well inside an enclosed container? In order to understand why plants inside a terrarium can prosper with very little attention, you must first understand how a terrarium works. After the plants in the terrarium have been initially watered and a good moisture level established, the cover is put in place and a moisture equilibrium (water cycle) is established. Such an equilibrium is very simple to understand and results from the fact that water inside an enclosed container cannot escape as vapor after it has evaporated.

Plants absorb water through their roots. It is used for necessary plant processes and transpired from leaves as water vapor. The vapor changes to water droplets that accumulate on the top and sides of the terrarium, making it appear cloudy. These water droplets condense and drain back into the soil where they are reused by the plants (see diagram). Because of the water recycling process, terrariums are often called miniature, self-operating greenhouses.

The high level of relative humidity in the terrarium makes it an excellent place for most plants to grow. The warm, moist, draft-free environment is a perfect place to root cuttings or start bulbs or seedlings. It is also a good place to rejuvenate ailing house plants. So, in addition to being decorative, terrariums serve a very real and useful purpose.



A miniature, self-operating greenhouse.

Terrarium Containers

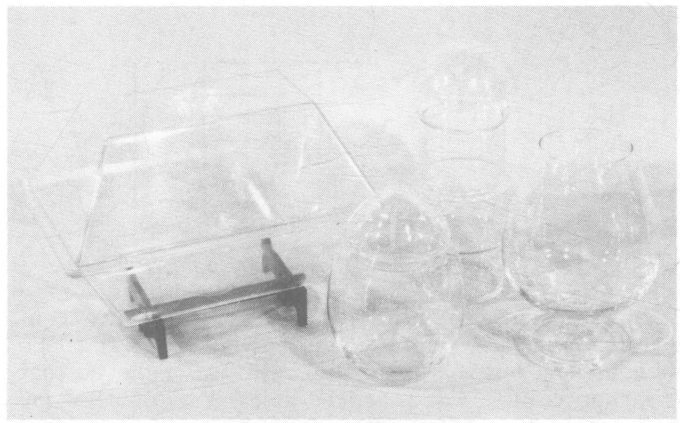
Terrarium containers are as varied as the imagination of their owners. Almost any clear container large enough to hold a plant and a small amount of soil can serve as a terrarium. Very often we find terrariums in brandy snifters, water bottles, glass canisters, cracker jars, and plastic cubes. You can find terrarium containers of all shapes and sizes in garden supply stores, department stores, and specialty shops.

Before buying a terrarium container, however, check the dark recesses of cabinets and cupboards. Hidden inside, one is sure to find the perfect container for a unique and original terrarium. Inexpensive glass cutters, sold in most department stores, make almost any bottle or jar a possible terrarium container.

Keep in mind when choosing a container that colored glass transmits only light of its own color and absorbs all other colors. Colored glass also reduces light intensity that can result in abnormal plant growth. **Never** use a green container. Green glass transmits only green light and blocks out red and blue light. Green light is of no use to plants and they will soon die if planted in a green container. Use only lightly tinted glass and shade tolerant plants, if a colored container is used.

Glass containers, although much more easily broken, do not scratch as easily as plastic containers and will stay new-looking indefinitely. The new Plexiglass and Lucite containers are excellent for terrariums but care must be taken to avoid scratching them when cleaning.

In order to maintain the humid environment needed for good plant growth, the terrarium should be covered. Whether it be a lid especially fashioned for the container and an integral part of its design or a piece of plastic food wrap stretched across the top, the cover serves the same purpose—creation and maintenance of high relative humidity.



Terrarium containers are available in a wide variety of shapes and sizes.

When choosing a terrarium container, think big. Small containers are attractive and very portable, but most plants soon outgrow this limited space and must be severely pruned or transplanted.

Bottles with narrow necks make striking and unusual terrariums, but inserting plants is difficult. This type terrarium should be attempted only by an experienced planter. Remember, the larger the mouth of the container, the easier it is to plant.

Terrarium Soil Mixes

The soil mix used in the terrarium is of primary importance. Always use a light, well-drained, porous soil mix. A mixture of one part sphagnum peat moss, one part coarse sand, and one part soil is most satisfactory.

Various soil mixes are available through garden centers.

Often the use of soil additives such as perlite (expanded volcanic rock) and vermiculite (a mica compound) is recommended for a terrarium soil mix. It is generally agreed that these substances will lighten the texture of a soil mix and aid in aeration and drainage. Perlite and vermiculite particles, because of their distinctive coloration, show up clearly through the transparent sides of a terrarium. This detracts sufficiently from the beauty of a terrarium and nullifies its value in this situation.

The use of sheet moss to hide the soil mix is often recommended. Sheet moss can be placed green side out in the bottom of a terrarium and secured in place by the soil and drainage materials. While this eliminates one's view of objectionable substances such as perlite and vermiculite, it can create a more serious problem. Sheet moss will start to grow in the warm, moist environment of a terrarium and can eventually spread to cover the interior sides of the terrarium, completely obscuring the view of other plants.

A soil mix containing perlite or vermiculite should consist of ½ part perlite or vermiculite, ½ part sand, 1 part sphagnum peat moss, and 1 part soil.

Packaged sand can be purchased from garden centers. Larger quantities are available through construc-

tion supply companies. The latter source is usually less expensive.

All constituents of a terrarium soil mix should be pasteurized. Most packaged materials purchased at garden supply stores have been pasteurized, but check the package to make sure. One can pasteurize the terrarium soil mix by placing it in an oven for one hour at a temperature of 180 degrees Fahrenheit.

When purchasing soil ingredients, do not confuse sphagnum moss with sphagnum peat moss. Sphagnum peat moss is decayed sphagnum moss. The latter material is commonly found either milled or shredded and is most often used for germinating seeds and starting bulbs. Sphagnum moss absorbs more than 20 times its weight in water and will not mix readily with other soil ingredients, unless submerged in water for several hours before being mixed; this will make the soil mix too wet. If used dry, it will float to the top of the soil mix after the initial watering and a poor distribution of water in the mix results.

Sphagnum peat moss can be used directly from the package. It is a lightweight, fibrous organic substance and an essential constituent of a good terrarium soil mix.

If one chooses not to mix the terrarium soil, commercial African Violet soil and prepared terrarium soil mixes are satisfactory for use in terrariums.

A small amount of low analysis fertilizer in the terrarium soil mix is often recommended. However, if you want terrarium plants to grow slowly, do not fertilize. Fertilizer may be added in small quantities after several months, although many terrariums are never fertilized.

Drainage Materials

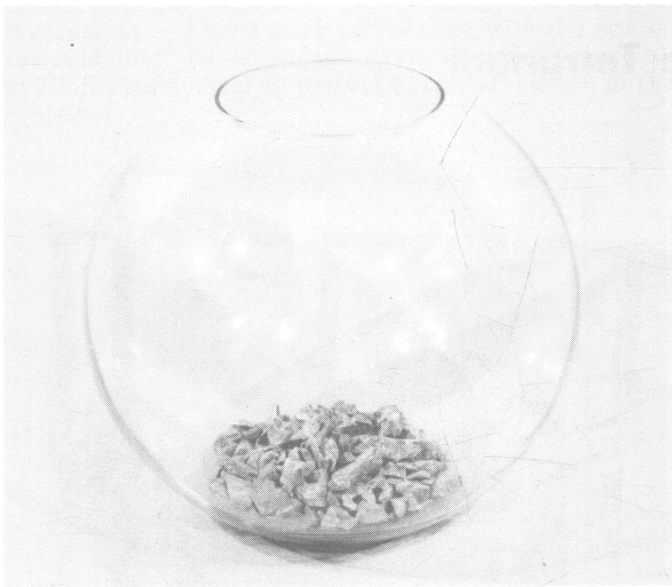
Since the terrarium is enclosed and water vapor cannot escape once the cover is put in place, do not over water. Add only enough water to establish an adequate moisture level (see section on "Watering the Terrarium"). Too much water will cause roots to rot and promote growth of various algae and fungi.

Avoid problems associated with too much water in the soil by adding drainage materials to the terrarium while it is under construction. In addition to using well-drained soil, place a layer of gravel and charcoal in the bottom of the terrarium to catch and hold excess water. Use 3 parts gravel to 1 part charcoal for the drainage layer.

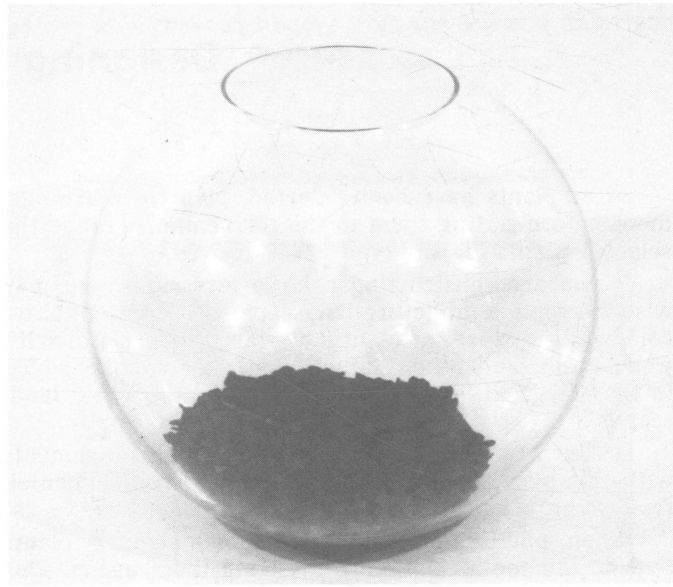
Place a layer of gravel in the bottom of your terrarium. The size and amount of gravel used will vary with the size of the container. Aquarium gravel is too fine for all but the smallest terrariums. Boil the gravel for one-half hour, if it has not already been pasteurized. Do not use marble chips in the drainage layer. This material alters the pH of the soil, making it too alkaline for most terrarium plants.

Place a layer of charcoal, about ½ inch in depth, on top of the gravel. Charcoal is recommended because it absorbs impurities and odors from the soil.

The combined depth of gravel, charcoal, and soil should not exceed 20 percent of the total height of the container. Too much soil makes it difficult to establish a proper moisture level inside the terrarium.

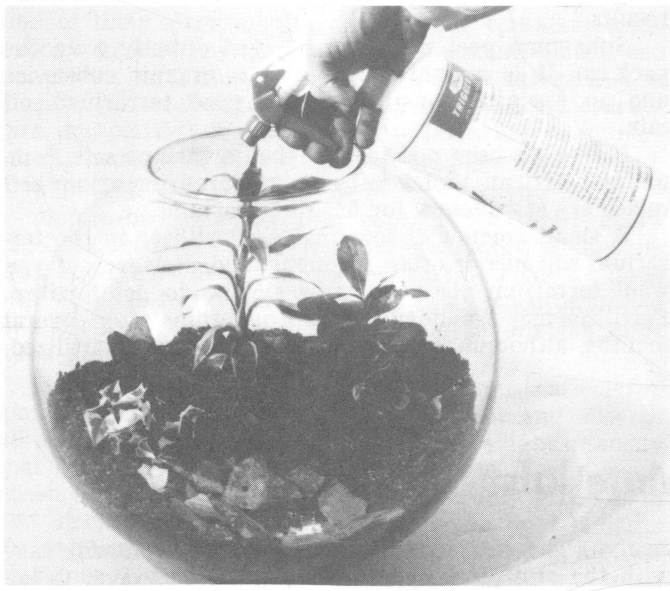


A layer of gravel is placed in the bottom of the container to catch and hold excess water.



Place a layer of charcoal, about one-half inch in depth, on top of the gravel to absorb impurities and odors.

Watering the Terrarium



Always add water sparingly through a mist bottle. Mist and clean foliage and the interior sides of the container.

Too much water is the cause of most common problems associated with terrariums. The initial watering of the terrarium as well as supplemental waterings must be carefully regulated. It is better to water too little than too much. Too much water reduces the oxygen supply to plant roots and promotes growth of algae and molds. Remember, more water can be added to a terrarium but excess water cannot be removed.

The soil mix used when planting a terrarium should be damp. Therefore, for the initial watering, add no more than ¼ cup (2 ounces) of water to small containers (1 gallon or smaller) and no more than ½ cup (4 ounces) to larger containers. Apply water through a mist bottle a bit at a time and allow it to be absorbed by the soil between sprays. Misting not only adds water slowly but also helps clean foliage and the interior sides of the container.

Leave a newly planted terrarium uncovered for several days. During this time, the soil moisture level can be adjusted. After 2 to 3 days, put the cover in place and carefully check the amount of fogging that takes place. The sides and top of the container should fog slightly. If fogging is too heavy and one is unable to see the plants in the terrarium, remove the cover for several more days. If no fogging takes place, add additional water sparingly. Fogging is also dependent on room temperature. The cooler the room, the more the terrarium will fog. A room temperature of 70 degrees Fahrenheit is most satisfactory for proper fogging to take place.

There is no fool-proof way to tell when a terrarium is in need of supplemental water. Water should be added when one sees a lightening of the color of the soil mix, accompanied by wilting of plant material. Also, a terrarium will stop fogging when there is need for additional water.

If chlorine or soluble salts are present in large quantities in your tap water, use only distilled or rain water. Since soluble salts cannot be leached from a terrarium, a build-up in the soil will reach a level high enough to distort plant growth and eventually kill plants.

Designing the Terrarium

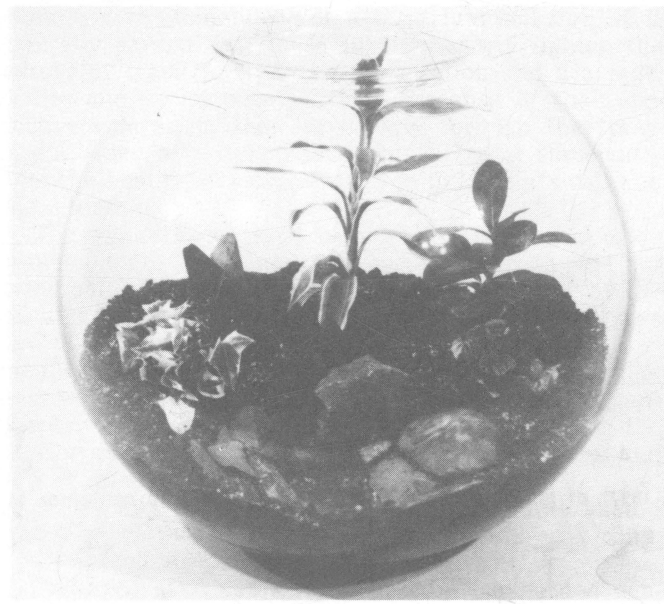
After plants have been selected, plan their arrangement before setting them in the terrarium. Arrange the selected plants for the type effect desired.

If you are constructing a large terrarium, you may wish to create a miniature landscape with different sizes, colors, and textures of plant materials. Stone, slate, driftwood, sand, and other natural materials can be added to the design to help capture the illusion of a real landscape.

Design smaller terrariums like flower arrangements with tall plants used as accent features complemented by low growing types.

When planting smaller terrariums, arrange plants outside the container before inserting them inside. This will help avoid unnecessary uprooting of plant material. In large terrariums, plants may be arranged while still in their pots.

Some rearranging after planting may be necessary, but a little planning helps keep this to a minimum and gets the terrarium off to a better start.



Decide the type effect you want and arrange plants accordingly.

Fertilizer Requirements

The recycling effect of the terrarium makes it unnecessary to fertilize or add chemical nutrients to the soil as often as is necessary with uncovered house plants. Just like the water in which they are suspended, plant nutrients cannot be lost from the terrarium by leaching or evaporation. Nutrients are, however, incorporated into plant tissue and slowly depleted from the soil and should be replenished periodically.

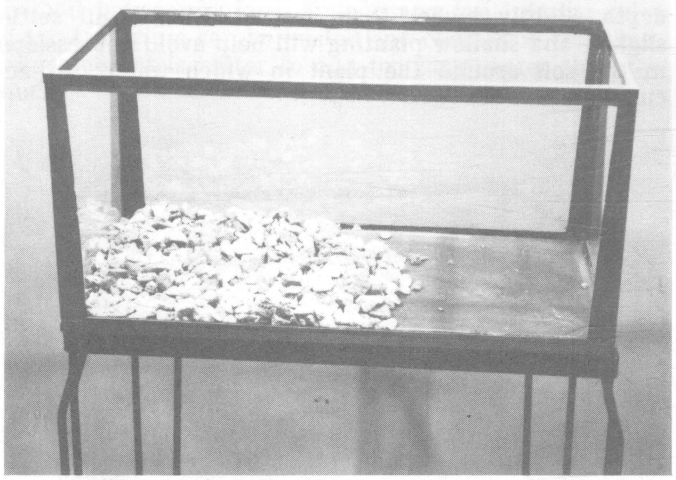
The slow growth desired of terrarium plants is facilitated by low levels of fertilizer in the soil. A slightly starved plant will remain smaller and more compact.

Fertilize the terrarium not more than once every three months. Use a general house plant fertilizer at one-fourth the recommended strength. Because of the plant growth fertilizer promotes, many people never fertilize their terrariums.

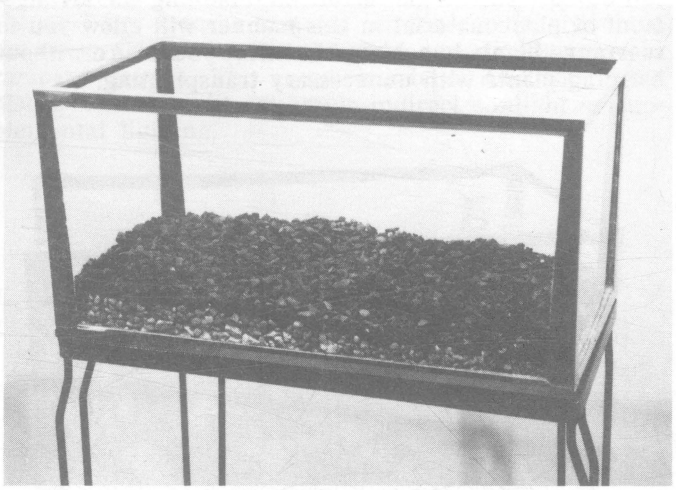
Avoid getting fertilizer on the foliage of terrarium plants.

Terrarium Construction in 10 Easy Steps

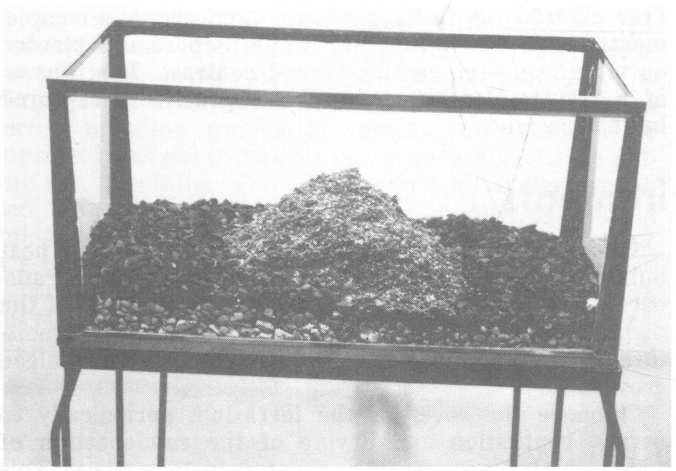
Thoroughly clean the container before starting construction of the terrarium. Make sure the container is free from detergent residue.



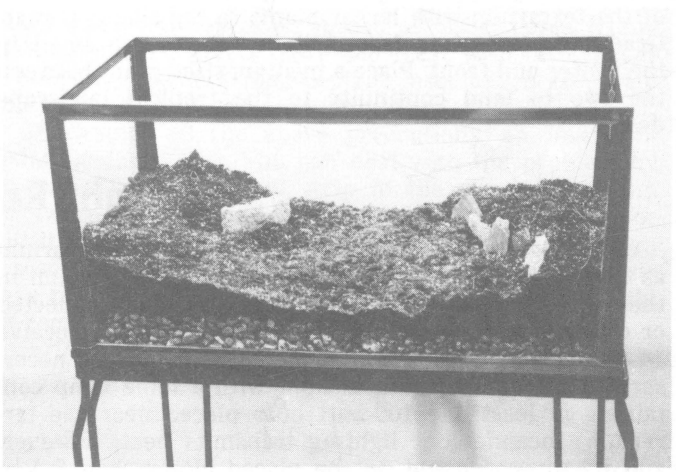
1. Place a layer of gravel in the bottom of the container to collect and hold excess water. The size and the amount of gravel used should vary with the size of the container. The combined depth of gravel, charcoal, and soil should equal 20 percent of the total depth of the container.



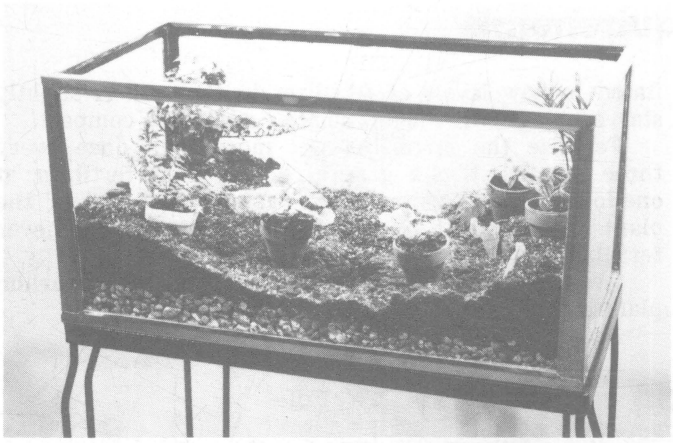
2. A layer of charcoal, about one-half inch in depth, should be placed on top of the gravel. Charcoal will absorb impurities and odors from the soil and water and aid in aeration and drainage.



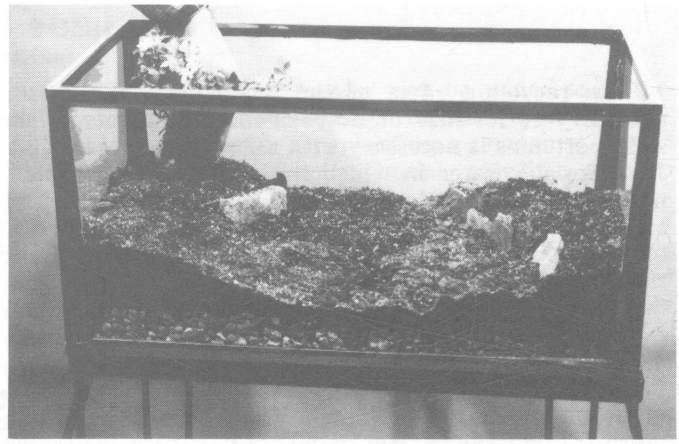
3. Add soil mix sparingly. The soil need only anchor the plant materials and provide a limited amount of space for root growth. Too much soil will make it difficult to establish a good moisture level inside the terrarium.



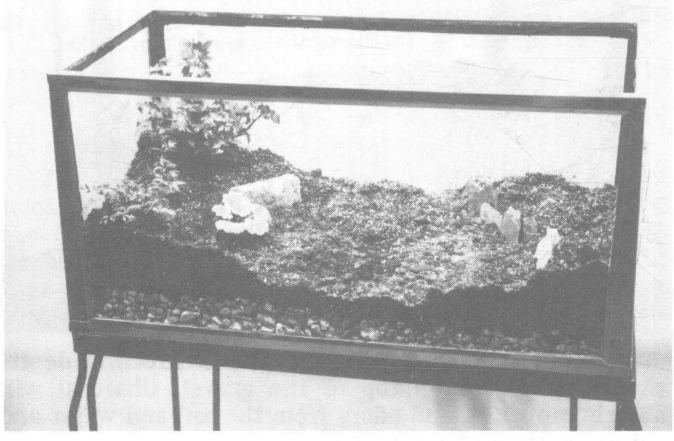
4. In a large terrarium, it is possible to add interest to the design by varying soil depths and establishing a natural looking terrain. The terrain should be created before plant materials are added. Slate and flat rocks should be firmly anchored to support different soil levels.



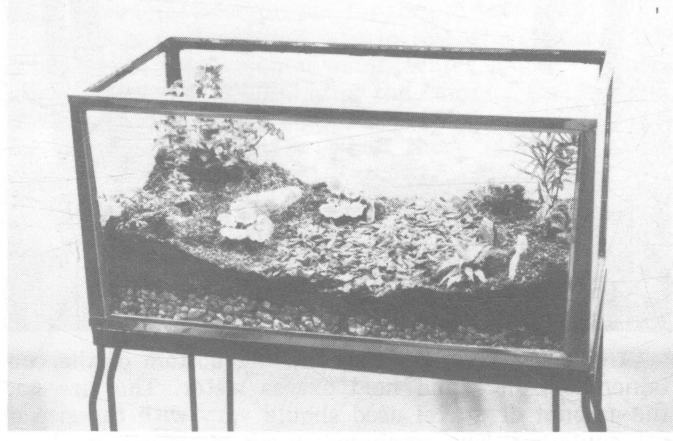
5. Arrange plant material while still potted as it will be planted. When working with large terrariums, this can be done inside the terrarium. Planning the arrangement of plant material in this manner will allow you to rearrange plants to achieve the effect you desire without harming plants with unnecessary transplanting.



6. After removing plants from pots, shake off much of the soil adhering to roots. Untangle roots and remove unsightly foliage. Place plants in prepared holes at a depth slightly higher than desired. Plants will settle slightly and shallow planting will help avoid depressions in the soil around the plant in which water can accumulate.



7. The simulation of a miniature landscape is achieved by varying sizes and shapes of plant material. Place small plants along the recessed area in the center of the terrarium with larger plants to the side and rear. Graduate plant sizes from tall in the rear to small in the center and front. Place a medium-sized plant between the two to lend continuity to the tropical landscape design.



8. Planting the terrarium is now complete. A stream or path, bordered by small, low-growing plant material, can be created with redwood chips. The tall Podocarpus (see diagram) with its distinctive leaf shape is complemented with dwarf Emerald Ripple Peperomias planted on either side for continuity and contrast. The illusion of a tropical landscape has been effectively captured in this design.

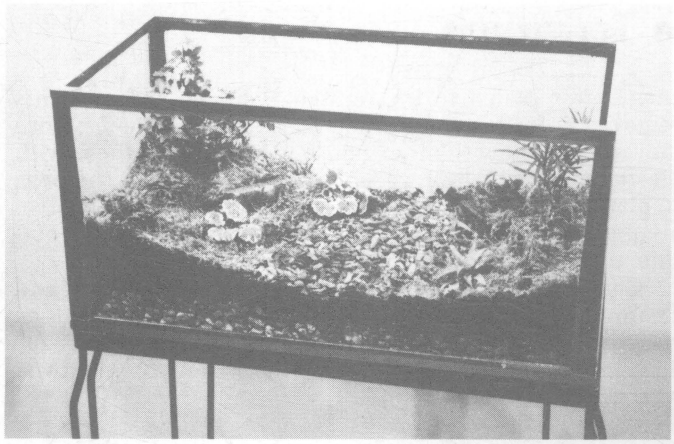
Light Requirements

Good light is as important to the plants in a terrarium as it is to all other house plants. Place the terrarium in the home or office where it will get as much reflected or diffused light as possible. A terrarium should receive 14 to 16 hours of bright light per day. It may be necessary to supplement natural light with a table lamp containing at least one 100-watt bulb placed near the terrarium. Incandescent lighting transmits heat, however, and its source should not be placed closer than 3 feet from the terrarium. Other types of supplemental lighting such as the new fluorescent color corrected tubes, especially designed for aiding plant growth, are available at garden supply and department stores.

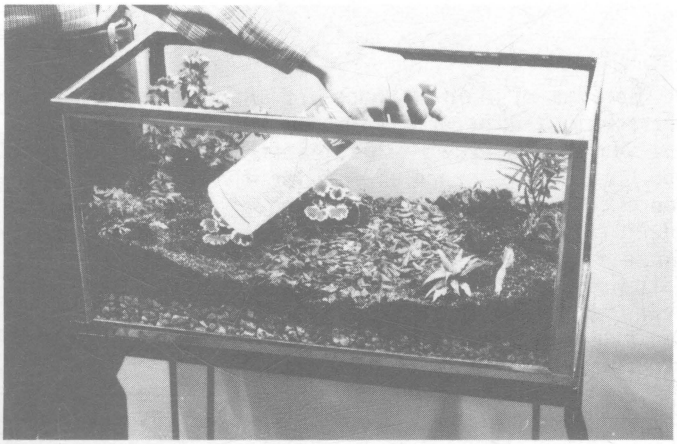
Never place a terrarium in direct sunlight. The heat build-up, which will take place inside an enclosed transparent container located in direct sunlight, will kill the plants. Too much sunlight will also cause excessive moisture condensation inside the terrarium and promote algae growth.

Remove the cover of the terrarium periodically to permit ventilation and drying of the condensation of water on the interior sides and top to take place. This will help control algae as well as regulate the temperature inside. A room temperature of 70 degrees Fahrenheit is satisfactory.

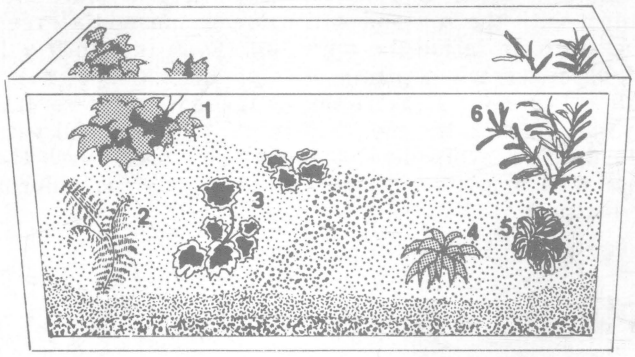
Plants grow toward the light source, so rotate the terrarium often to prevent the lopsided plant growth.



9. Always water your terrarium with a mist bottle. Four ounces of water should be initially added to a large terrarium a bit at a time and allowed to be absorbed by the soil between sprays. Foliage and the interior sides of the terrarium can be misted and cleaned at this time. Remember, it is better to add too little water than too much.



10. The soil mix can now be covered with sheet moss as it might appear in the wild. Mist the moss lightly. Eventually it will start growing. Care must be taken in the next few months to avoid too vigorous a growth of the moss. Cut back and trim moss periodically to avoid rampant growth. The completed terrarium should be placed where it will get ample indirect sunlight or supplemental lighting.



Key

1. Hedera helix—English Ivy
2. Davallia bullata mariesi—Squirrels Foot Fern
3. Saxifragra stolonifera 'Tricolor'—Magic Carpet Saxifrage
4. Cryptanthus bivittatus minor—Cryptanthus
5. Peperomia caperata 'Emerald Ripple'—Emerald Ripple Peperomia
6. Podocarpus macrophyllus—Yew Podocarpus

Insect Problems

If proper precautions are taken at the time the terrarium is constructed, there is little danger of an infestation of insect pests. Always use pasteurized soil. The warm, moist microclimate of the terrarium makes it a perfect breeding ground for harmful soil organisms, if unpasteurized soil is used. If you purchase packaged potting soil, check the label to make sure it has been sterilized. If you use soil from the garden or reuse old potting soil, pasteurize it by placing it in an oven for one hour at a temperature of 180 degrees Fahrenheit.

Examine plants carefully for insects and treat with insecticides, if necessary, before planting. Newly purchased plants should be quarantined for two weeks to guard against the possible spread of insect pests. Examine quarantined plants daily and treat with insecticides if necessary. General house plant insecticides are available at your local garden supply store.

If, despite all the above precautions, an insect infestation does occur, you can deal with the problem by placing a vapona no-pest strip in the closed terrarium for two days. This will not harm terrarium plants nor will it fog the interior sides of the terrarium, as will an aerosol spray. Badly infested plants on which the pests have not been killed by the pesticide treatments should be removed from the terrarium and discarded.

Maintaining the Terrarium

Because of limited space for plant growth in the terrarium, it is necessary to trim and prune fast growing plants that crowd other plants. When a plant gets too large for the space allotted for it, pinch it back to a more satisfactory size. Do not be afraid to ruthlessly pinch back a plant. Plants will grow back all too soon. Some plants such as single stem and stemless rosette varieties cannot be trimmed. Even though plants of these types will eventually have to be removed, they can exist for a long time in a terrarium, if extra outside leaves are removed from time to time.

Most plants will outgrow the available space in a terrarium in 1 to 2 years. Replace oversized plants with ones better scaled to the limited available space. Plants removed from terrariums should be hardened-off before they are placed with other house plants. Cover them with plastic bags for 1 to 2 weeks. Gradually remove the bags so plants slowly become acclimatized to the lower relative humidity and temperature fluctuations of the world outside the terrarium.

General housekeeping, rearranging of ornaments, and cleaning of foliage and decorative materials should be attended to periodically. Always be on the lookout for dead or rotting vegetation, which should be removed when first noticed.

Common Terrarium Problems

Molds and other fungi often appear and cause problems in a terrarium that is too wet. In all terrariums, a certain amount of fungus will be present on dead plant remains and on leaves allowed to touch the side of the container. The microclimate of the terrarium makes it a perfect place for molds to flourish and they should be dealt with as soon as they are noticed. Remove and discard all infected plants or plant parts. A fungicide spray such as benomyl should be effective. Some plants such as the miniature rose are especially susceptible to molds and should be treated with a fungicide before planting. Provide better ventilation and more light for terrariums with fungus problems by removing the lid and allowing excess moisture to evaporate.

The high relative humidity in the terrarium makes it the perfect place for algae to grow. Algae will grow on the soil surface and on the glass where it comes into contact with the soil and will cause an unsightly green muck to form inside the terrarium. Even though it will not harm terrarium plants, it is an indication of a too high relative humidity. Remove the cover for several days and reduce the moisture level. Treat the soil with algicide pills, available at tropical fish stores. Wash the glass with a mixture of water (1 gallon) and chlorox (1 teaspoon).

Terrarium Plants

All plants listed are common varieties and are readily available in tropical plant stores and garden centers.

Good Plants

Plants listed in this category will remain small for an extended period of time and are known to grow well in terrariums.

Acorus gramineus (Dwarf)—Dwarf Japanese Sweetflag
Acorus gramineus variegatus—Japanese Whitestripe Sweetflag
Buxus microphyllajaponica—Little Leaf Boxwood
Buxus sempervirens—Common Boxwood
Buxus sempervirens 'Marginata'—Variegated Common Boxwood
Carissa grandiflora—Natal Plum
Chamaedorea elegans—Parlor Plum
Cryptanthus bivittatus minor—Cryptanthus
Euonymus japonica 'Albomarginata'—Silveredge Evergreen Euonymus
Euonymus japonica 'Mediopicta'—Yelloweye Evergreen Euonymus
Euonymus japonica 'Silver Queen'—Silver Queen Euonymus
Ficus pumila minima—Miniature Creeping Fig
Hedera helix 'Needlepoint'—Needlepoint Ivy
Peperomia orba
Peperomia rubella
Pittosporus tobira—Japanese Pittosporum
Pittosporus tobira 'Variegata'—Variegated Japanese Pittosporum
Podocarpus macrophyllus—Yew Podocarpus
Polyscias fruticosa—Parsley Aralia
Saxifragra stolonifera—Strawberry Begonia
Saxifragra stolonifera 'Tricolor'—Tricolor Strawberry Begonia
Selaginella spp.—Spike Mosses
Sinningia pusilla—Miniature Gloxinia

Plants shown are, left to right, Yew Podocarpus, Strawberry Begonia, and Nephthytis.

Fair Plants

Plants listed here are excellent for use in large terrariums. Limit their use to terrariums of 5 gallons or larger. These are faster growing varieties and may become too large in a shorter period of time.

Adiantum raddianum—Pacific Maidenhair
Adiantum hispidulum—Dwarf Maidenhair
Aeschynanthus radicans—Lipstick Plant
Araucaria heterophylla—Norfolk Island Pine
Asparagus setaceus—Fern Asparagus
Begonia argenteo-guttata—Angel Wing Begonia
Columnea microphylla—Small Leaf Goldfish Vine
Cryptanthus species—Cryptanthus
Davallia species—Squirrels Foot Fern
Dionaea muscipula—Venus Fly Trap
Dizygotheca elegantissima—False Aralia
Dracaena deremensis 'Warneckei'—Warnecke's Dracaena
Dracaena surculosa 'Florida Beauty'—Spotted Dracaena
Dracaena sanderiana—Sander's Dracaena
Fatshedera lizei—Fatshedera
Fittonia verschaffelti argyroneura 'Mini'—Dwarf White Nerve Plant
Hedera helix—English Ivy
Iresine spp.—Bloodleaf
Peperomia caperata 'Emerald Ripple'—Emerald Ripple Peperomia
Peperomia obtusifolia—Ovalleaf Peperomia
Peperomia prostrata
Pilea cadierei—Aluminum Plant
Pilea depressa—English Baby Tears
Pilea involucrata—Panamiga
Pilea microphylla—Small Leaf Artillery Plant
Saintpaulia ionantha—African Violet (Miniature Selections)
Senecio macroglossus 'Variegatum'—Variegated Wax Vine
Tolmea menziesi—Piggy-Back Plant

Left to right are Spotted Dracena, Cryptanthus, and Parlor Palm.

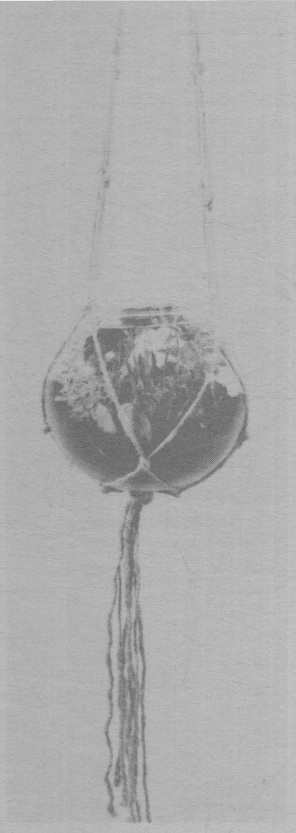
Poor Plants

Plants in this category are generally considered to be too large for use in terrariums. They are satisfactory in only the largest terrariums—20 gallons or larger.

Alternanthera—Joseph's Coat
Asplenium nidus—Bird's Nest Fern
Codiaeum—Croton
Coleus—Coleus
Epipremnum (Scindapsus or Pothos) aureum—Pothos
Fatsia japonica 'Moseri'—Japanese Fatsia
Cynura spp.—Velvet Plant
Hoya carnosa and selections—Waxplant
Maranta leuconeura kerchoveana—Prayer Plant
Nephrolepsis exaltata 'Fluffy Ruffles'—Fluffy Ruffles Fern
Pilea serpyllacea—Large Leaf Artillery Plant
Pteris ensiformis 'Victorae'—Victoria Sword Brake
Rhoeo spathacea—Moses in the Bullrush
Senecio mikanioides—German Ivy
Syngonium podophyllum—Nephthytis
Tradescantia fluminensis—Wandering Jew
Zebrina pendula—Zebrina

English Ivy.

These plants are, left to right, English Ivy "Needlepoint', Peperomia, and Aluminum Plant.



Samples of Completed Terrariums

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